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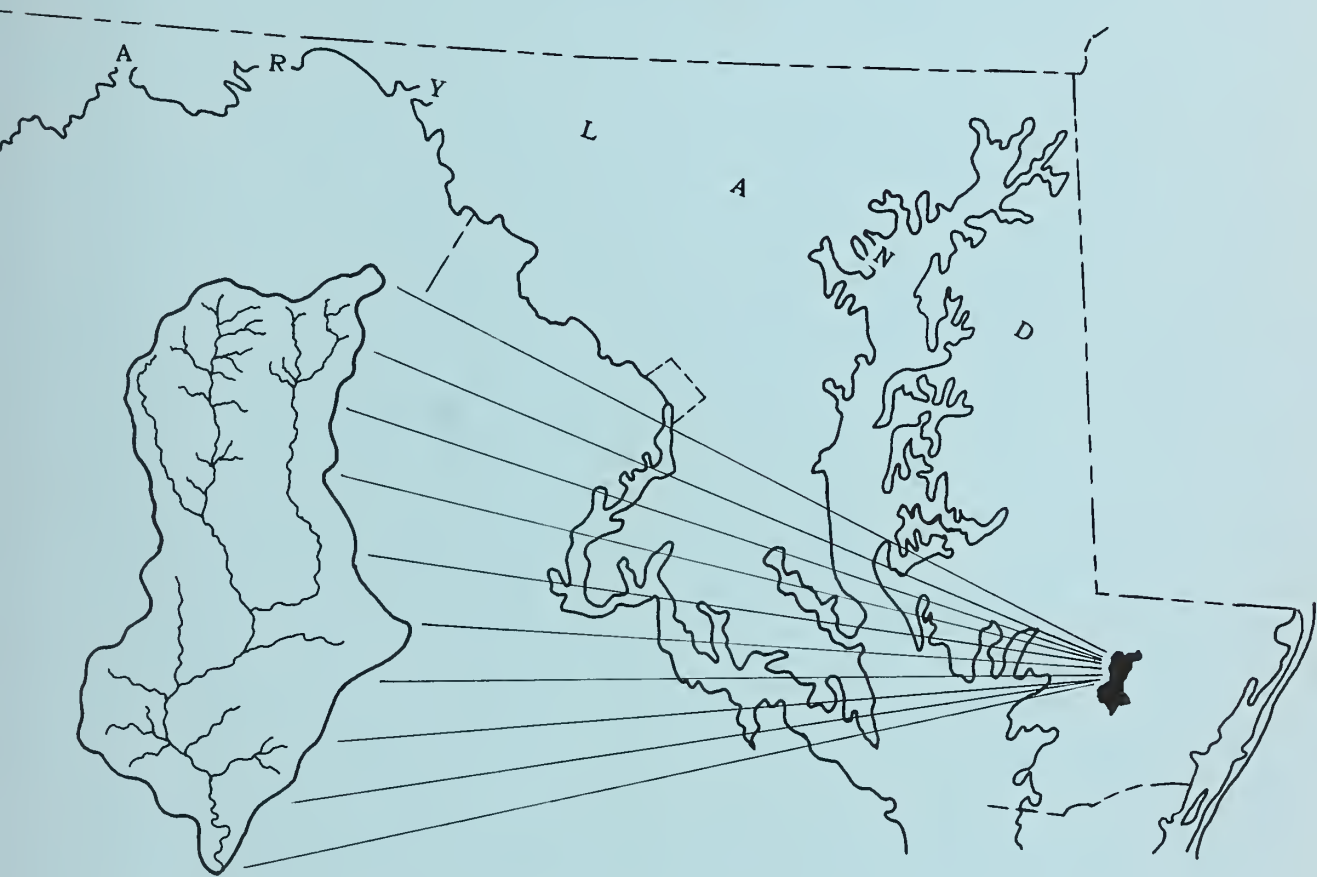
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WORK PLAN for the DIVIDING CREEK WATERSHED



WICOMICO, WORCESTER, AND SOMERSET COUNTIES
MARYLAND

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SEPTEMBER 1970

WATERSHED WORK PLAN
DIVIDING CREEK WATERSHED

Worcester, Wicomico and Somerset Counties, Maryland

Prepared under the Authority of the Watershed
Protection and Flood Prevention Act (Public Law
566, 83rd Congress, 68 Stat. 666) as amended.

Prepared by

Worcester Soil Conservation District
Worcester County Commissioners
Wicomico Soil Conservation District
Wicomico County Council
Somerset Soil Conservation District
Somerset County Commissioners

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August 1970

DIVIDING CREEK WATERSHED

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WATERSHED WORK PLAN

Dividing Creek Watershed
Worcester, Wicomico and Somerset Counties, Maryland

August, 1970

SUMMARY OF THE PLAN

The Dividing Creek Watershed is located in the Western part of Worcester County, the Southern part of Wicomico County and the Eastern part of Somerset County. The watershed drains an area of approximately 41,900 acres and flows in a Southerly direction to join the Pocomoke River about 2 miles Northeast of Pocomoke City, Maryland. The lower reaches of the main stream are tidal.

The local sponsoring organizations are: The Worcester, Wicomico and Somerset Soil Conservation Districts, the Wicomico County Council and the Worcester and Somerset County Commissioners.

Approximately 72 percent of the agricultural cropland in the watershed has joint problems of flooding and inadequate drainage on the flat coastal plain soils. Agricultural production is seriously restricted in the area by inadequate drainage and periodic flooding. The work plan proposes that a system of approximately 87.0 miles of multiple purpose channel improvements will be concentrated primarily in the upper 44 percent of the Watershed. Main stem channel improvements will start approximately 12 miles above the confluence of Dividing Creek and the Pocomoke River leaving at least 12 miles of natural channel and flood plain in the lower 56 percent of the watershed. A small number of minor tributaries to be constructed on the outer fringe areas in the lower part of the watershed will terminate well above the Main Stem flood plain. The structural measures and land treatment measures will be installed in the watershed over a seven year period. The works of improvement are composed of three construction units having approximately 60.4, 6.6 and 20 miles of channel improvement.

The project has been thoroughly reviewed with the Maryland Department of Natural Resources and Federal Fish and Wildlife Service. No adverse effect to downstream areas is expected. Main stem channel improvements will be constructed with mitigation measures to protect the desirable environmental features of the watershed. Sediment basins will be constructed at the lower end of construction on the main stem and each independent tributary. The side slopes of the ditch will be seeded the day of construction. To protect anadromous fish runs in the lower reaches of the stream, no channel excavation will be done during the period March 15 through June 15 without concurrence from the Maryland Department of Natural Resources.

The total project cost is \$1,683,509. The Public Law 566 share of this cost is \$1,007,965. Other funds to be used for the remainder of the cost are \$675,544.

The cost of installation of land treatment measures is estimated to be \$465,440. Public Law 566 will bear \$136,640 of this cost for accelerated technical assistance by the Soil Conservation Service and the Forest Service. Other funds will provide \$328,800.

The construction cost of the multiple purpose channel improvements will be \$724,333. The Public Law 566 share of this cost is \$543,248 and the other share is \$181,085.

The total engineering services cost, \$98,120, will be paid by Public Law funds. The total cost for land rights, \$152,659, will be borne by other funds. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs estimated to be \$13,000 and \$229,957 respectively.

Development of rural areas will be enhanced by the planned improvements. Improved economic conditions of the farm families through increased net income will be the primary effect of the project. The average annual increase in net returns is estimated to be approximately \$610 for each of the 340 farms with the project installed.

The main crops, corn and soybeans, are utilized by local processing plants. The channel improvements will permit diversification of protected cropland and pastureland to truck crop production and provide more time to establish cover crops.

The average annual primary benefits accruing jointly to the multiple-purpose channel improvements total \$165,573, of which \$159,106 is attributed to damage reduction and increased yields and \$6,467 from changed land use. The local secondary benefits total \$26,726. Secondary benefits from a national viewpoint were not considered pertinent to the project evaluation. The ratio of average annual benefits, \$192,299, to annual costs, \$79,500, is 2.4:1.0.

The annual cost includes \$52,085 amortized structure installation cost and \$14,042 estimated annual cost of operation and maintenance.

The multiple-purpose stream channel improvements will be installed by the Public Drainage Associations as required. The sponsors will organize such associations under authorities granted by State Law. The sponsors will provide financial and technical assistance to the associations according to established procedure.

The multiple-purpose channels will be operated and maintained by Public Drainage Associations to be organized by the sponsors. Specific Operation and Maintenance Agreements will be executed prior to issuance of invitations to bid on the construction contract. Land treatment measures will be operated and maintained by the owners and operators of the farms on which the measures are installed.

DESCRIPTION OF THE WATERSHED

Physical Data

The Dividing Creek Watershed is located on the Eastern Shore of Maryland in the Western part of Worcester County, the Southern part of Wicomico County and the Eastern part of Somerset County. The watershed drains an area of approximately 41,900 acres and flows in a Southerly direction from its headwaters in Wicomico County to join the Pocomoke River about two miles Northeast of Pocomoke City, Maryland. The lower reaches of the main stream are tidal.

Total watershed area is 41,900 acres, of which 7,169 acres are cropland, 138 acres are pasture, 34,436 acres are woodland, and 157 acres are in other uses.

Corn and soybeans are the principal crops; however, some small grain and truck crops are being grown.

Soils in this watershed are of coastal plain origin and about 90 percent are poorly drained. The soils are suitable for agriculture when well managed, drained and protected from flooding.

The normal growing season is 190 days and ranges from mid-April to late October. Average annual temperature is 58.0 degrees F., and ranges from an average minimum in January of 38 degrees F. to an average maximum in July of 76 degrees F.

The average annual precipitation is approximately 46 inches and is evenly distributed throughout the year with somewhat higher amounts occurring in March, July, and August. The rainfall in July and August is usually from high intensity thunderstorms of short duration. These thunderstorms produce flooding due to direct precipitation throughout much of the watershed.

The major water uses are domestic, agricultural, and industrial. These requirements are generally satisfied by wells.

Approximately 82 percent of the area (34,436 acres) is in forest cover. Presently, the overall hydrologic condition of the forest land is fair. With continued protection and application of sound forest management practices, the hydrologic condition of most of the forest land can be expected to improve by the end of the 50-year evaluation period.

Economic Data

The watershed is entirely rural with an agriculture economy based on cash grains, truck crops, poultry and dairy enterprises. There are several agricultural related industries in or near the watershed including the Green Giant Company and the Crown Cork and Seal Company, Incorporated. These plants when operating at full capacity employ approximately 670 people.

The Somerset Redevelopment Corporation has been established to attract new industry, develop the area, and reduce unemployment.

Agriculture plays an important role. There are approximately 340 farms in the watershed. According to the 1964 Census of Agriculture, the farms in Wicomico, Worcester, and Somerset Counties average 156 acres in size. The average value per farm including buildings is \$41,263. Most of the farms are operating as family type units. Thirty-two percent of the farm operators work off the farm more than 100 days per year. Farms in the watershed will generally follow county figures; however, production may be lower than average due to the poor drainage and flooding conditions in the watershed. Size, too, will be below average due to the truck and poultry farms within the watershed.

Land use studies show that approximately 100 percent of the watershed is in rural land. Of this, 18 percent is in cropland. The main crops include corn, soybeans, and truck crops. Approximately 82 percent of the watershed is in forest cover. Approximately 71 percent of the cropland and 93 percent of the woodland is poorly drained. Less than one percent of the watershed is in other uses including towns, homesteads and miscellaneous.

The forest lands within the watershed are composed of three major cover types. The loblolly pine type is the most prevalent and consists of approximately 65 percent of the total forest land area. Bottomland hardwoods represent approximately 20 percent with the remaining 15 percent in the mixed oak-pine type.

Excellent softwood markets exist for poles and piling, sawtimber, plywood veneer and pulpwood including pulp chips with loblolly pine comprising the large majority of this market. In contrast, hardwood markets are fair at best. Minor amounts of veneer and white oak staves are marketed with a very limited amount of poles, piling and chips being utilized.

There are 4,850 acres of State forest land in the watershed, located in the Pocomoke State forest, and administered by the Maryland Department of Forests and Parks. The average farm woodlot is about 25 acres in size, but much of the privately owned forest land is in larger tracts with the largest ownership being about 5,000 acres. The Foster Estate of 950 acres is located along the northeast edge of the watershed. This owner cooperates with Maryland's Department of Forests and Parks and Fish and Wildlife Administration resulting in well managed forest land for multiple benefits. Six forest industries own a significant portion of the forest land.

Adequate forest fire protection has and is being provided by the Maryland Department of Forests and Parks in cooperation with the U.S. Forest Service through the Clarke-McNary Cooperative Fire Control Program. Neither present nor future fire occurrence justifies additional measures beyond the going program. Other current Federal-State forestry programs include Cooperative Forest Management, Cooperative Forestation and Cooperative Insect and Disease Control. Given protection, care and management, the woodlands are expected to increase their contribution to the general economy of the watershed. Woodlands receiving good management will provide better recreation opportunities and produce more wildlife and timber products than misused woodlands. These benefits can be realized without reducing the capability of forest cover to protect the soil and water resources from erosion and sediment.

U. S. Route 13 and the Pennsylvania Railroad parallel the watershed on the West and the farms are within a short hauling range to market and freight service at Salisbury, Princess Anne and Pocomoke City located to the West and South of the Watershed and Snow Hill on U.S. Route 113 to the East. There is a good system of secondary roads throughout the watershed. Average farm to market distance is less than ten miles.

Local feed mills have been established to supply the broiler industry. The Delmarva Peninsula produces only 80 percent of the corn needed to supply its broiler industry's demand for feed grains. Poultry processing plants have been established to handle the local broiler supply.

The watershed lies partially within the Somerset Soil Conservation District, the Wicomico Soil Conservation District, and Worcester Soil Conservation District. There are a total of 96 active soil conservation district cooperators in the watershed. These cooperators have developed 61 basic farm plans. Essential conservation treatment has been established on 2,678 acres of cropland, 77 acres of pasture and 1,220 acres of forest land.

The conservation practices used to treat these acreages are shown in Table 1A.

Fish and Wildlife Resource Data

Of the 34,436 acres of woodland habitat in the watershed, approximately 22,500 acres are of the loblolly pine type supporting characteristically low populations of wildlife except in recent cut-over areas and where they border cropland. The approximately 5,000 acres of mixed oak-pine type woodlands and approximately 6,900 acres of bottom land hardwoods support moderate to high populations of deer, squirrel and other associated animal species.

Turkeys have recently been released in the watershed. Particularly important is the fact that this present area provides habitat for two federally declared endangered species - the Delmarva Bryant's fox squirrel and the bald eagle. The area is also utilized by Osprey.

Included in the bottom land hardwoods are 3,400 acres of ecologically valuable wooded swamp (classified as Type 7 wetlands) in a long narrow belt along the main stream and major tributaries. (Watershed construction will be beside or through approximately 210 acres of the upper reaches of the wooded swamp.) These wooded swamp areas provide excellent habitat for wood ducks, some black ducks, woodcocks and songbirds, and provide a variety of food and cover for numerous other game and non-game species populating the surrounding woodland. The lower reaches of the wooded swamp support a unique stand of bald cypress.

The 7,169 acres of cropland and 130 acres of pasture in the watershed provide variable but generally moderate quality habitat for upland game, mainly bobwhite quail, and rabbits, and associated openland non-game wildlife. Edges of farm woodlots and old ditches overgrown with brush and trees provide abundant escape cover for quail. However, grassy nesting cover and late winter food are often in short supply. Temporary

spring flooding of low areas and along ditches with poor outlets destroy many quail nests. Hunting pressures on quail and rabbits are generally low with fair success.

Some geese currently use the crop fields during the fall and winter for feeding. Their numbers have increased annually since 1966 when geese were practically non-existent in the watershed and are expected to continue increasing. Populations of other species of waterfowl are very low in the watershed.

Dividing Creek itself and its major tributaries contain abundant aquatic plants and foods utilized by resident species of fish. Native amphibians and reptiles are abundant. The upper reaches of the streams, where all the project construction will take place, often go dry in the summer resulting in a fishery of very low value. Anadromous alewives and blue back herring annually migrate and spawn up the main Dividing Creek to the vicinity of Fleming Mill Bridge Road, 5.3 miles below planned construction.

WATERSHED PROBLEMS

Land Treatment Problems

The major land treatment problem is excess floodwater and inadequate drainage on farm lands. On-farm drainage systems have been installed on some of the farms. Inadequate group outlets have limited effectiveness of the drains which have been installed and have prevented the application of drains on other areas. Due to wet field conditions in the fall, a limited acreage can be treated with cover and green manure crops.

Farmers in the watershed express a desire to produce more truck crops. Wet field conditions have made it unfeasible to produce these high value crops. With flood protection and adequate drainage, the shift of some of the present land use to truck crop production will become feasible. This change in intensity of land use will provide employment for available labor. Truck crop production will better suit the small farms making better use of land, labor and capital.

Capital is available to install more land treatment measures. The limiting factor is the excess moisture conditions; however, with protection from flooding and with improved drainage, landowners will be better financially as well as physically able to install needed land treatment measures.

Floodwater Damage

Flooding in the watershed results from out of bank flow near the channels and inundation of large areas due to accumulation of surface water. Broad areas of the flat lands are inundated since existing channels are inadequate to convey the floodwater from farm lands. Heavy crop losses from this type of flooding can be expected about one year in five. The flooding accompanies local thunderstorms and occasional tropical storms occurring most frequently after crops have been established, resulting in heavy damages. About 5,260 acres of openland are flooded and 32,360 acres of forest land are subject to some flooding.

Road and bridge flood damages occur at 110 points where roads cross the channels. Road fill is washed away at pipes, culverts and bridges. Damages to road shoulders and in some cases to the roadbed itself occur at times of flood.

Problems Related to Water Management

Seasonal high water tables affect the problem area cropland and forest land. Landowners and operators have not been able to establish effective on-farm drainage measures due to inadequate outlet channels. Poor drainage conditions have prevented farmers from meeting desired planting and harvest schedules and from taking advantage of modern farming methods. Total crop losses are sustained in low areas where ponding is experienced for extended periods. Weed control is a problem in areas where wet soil conditions prevent proper cultivation. Shallow root development caused by high spring water tables contributes to drought problems in the summer when the water table recedes. The use of cover and green manure crops is limited by the rise of the water table in the fall. This high fall water table affects crop harvest by preventing access to the fields with heavy harvest machinery. Wet soil conditions also pose problems during timber harvest.

Just below where the proposed project main channels end some adequate outlets exit and some on-farm drainage has been installed.

The combination of floodwater damage and inadequate drainage causes reduced crop yields, limits crop diversification, increases crop production costs, limits the use and effectiveness of lime and fertilizer, destroys nests of ground nesting birds and generally the area.

Erosion Damage

Due to the flat topography, gully and sheet erosion are minor in the watershed. Some slight wind erosion occurs seasonally on the few acres of well drained soils in the watershed. Although erosion and the accompanying sediment productions are slight, even small amounts of sediment are significant when they are deposited in farm ditches and outlet channels.

Sediment Damages

Sediment damages are not extensive in the watershed. Some localized sedimentation does occur and it complicates drainage and floodwater runoff by reducing transmission capacity at bridges, culverts and pipes and by building bars behind fallen trees and debris. In the intermittent streams, these sediment deposits are quickly vegetated. Roadway shoulders and present ditch banks are the primary sediment source areas and are most productive during periods of intense rainfall and runoff.

Fish and Wildlife

Of major importance is the small game populations utilizing the brushy vegetation growing along streams and ditches next to cultivated fields. Measures to preserve, replace and improve habitat conditions are considered

in the works of improvement. Forestry practices on woodland areas can benefit wildlife populations as well as the hydrologic condition and the timber resource. When forestry practices are planned, they will take into consideration the wildlife species affected by the changes in the habitat. Stream fishing resources are of low value in the upland area and downstream as far as Flemming Mill Road. There is generally a lack of good waterfowl habitat in the watershed. It could be improved by developing shallow water impoundments or renovating and/or maintaining old mill ponds along the stream channel.

Anadromous fish use the lower reaches up to approximately Flemming Mill Pond for spawning. Channel excavation work, except for clearing, during the period of March 15 through June 15 may proceed only with the concurrence of the Maryland Department of Natural Resources. A sediment basin will be constructed at the downstream end of each of the two major channel systems.

There is approximately 3,400 acres of wooded swamp along the major channels concentrated predominately in the lower part of the watershed. Approximately 210 acres of this type of resource lies in an area proposed for channel improvement. The topography of the flood plain restricts the spread of this critical wetland type to a narrow belt along the main channel and major tributaries. Measures have been proposed and agreed upon to reduce and mitigate these losses with the Maryland Department of Natural Resources.

The Cypress swamps located along the stream in the Southern portion of the watershed and the Pocomoke River are one of the biologically unique wetlands located in the State of Maryland. The sponsors and residents will recognize the value of this diminishing species in Maryland continue their preservation. No works of improvement are proposed in this area.

PROJECTS OF OTHER AGENCIES

There are no other proposed or existing works of improvement for water resource development which will affect or be affected by the works of improvement included in the work plan.

PROJECT FORMULATION

The land treatment goal for the project is to have 75 percent of the cropland, pasture and forest land treated with essential conservation practices by the end of the project period. Accelerated efforts will be made to have all of the land under cooperative agreements with the Somerset, Wicomico and Worcester Soil Conservation Districts.

Improvement of farm income is the primary purpose of the project. The land treatment working in conjunction with the stream channel improvements will improve soil moisture conditions which will increase crop production and increase farm income. Shifting grass and field crops to high value truck crops will become feasible with the project. This land use conversion will improve farm family income, particularly on the smaller low income farms, and will work to prevent an increase in surplus crop production.

The cropland and forest land treatment, land use adjustments, and the installation of the structural measures will make the watershed an outstanding example of soil and water conservation.

Channel design criteria of the standard that provides for "good agricultural drainage and adequate level of flood protection" has proven adequate in similar channel improvement projects to meet flood prevention and drainage needs. The system of improved channels will extend to two or more beneficiaries requiring adequate outlets for private on-the-farm drainage.

The channel project selected was developed in cooperation with local steering committees, including drainage viewers, appointed by the County Commissioners or County Council of each county and the Maryland Department of Natural Resources. The works of improvement proposed for this watershed consist of approximately 87.0 miles of multiple-purpose channels eligible for PL-566 cost sharing. The monetary benefits from the structural measures will not accrue primarily from bringing new land into agricultural production. The benefits from each separable segment will exceed costs.

To preserve as much of the environmental quality of the area as possible, the Sponsors and the Service worked out a satisfactory agreement with the Maryland Department of Natural Resources. On Pusey Branch the proposed channel improvements have been moved over to the west side of the flood plain and a continuous spoil levee left on the wooded wetland side. Continuous natural low flow is preserved in the old channel by construction of a system of controls at the upstream and downstream ends of the proposed diversion. Sediment basins are planned at the outlet end of major channel improvements. In order to protect the anadromous fish runs, no excavation should take place during the period of March 15 through June 15, unless concurrence is obtained from the Department of Natural Resources. Details of the mitigation channel measures are described in the "Works of Improvement To Be Installed". On Main Dividing Creek there has been some discussion on a proposal for the future development of two privately owned and sponsored lakes. The main outlet channel has been designed in such a way that it will operate satisfactorily with or without the proposed impoundments.

The Cypress swamps located along the stream in the Southern portion of the watershed and the Pocomoke River are one of the biologically unique wetlands located in the State of Maryland. No works of improvement are proposed in this area. The sponsors and residents will recognize the value of this diminishing species in Maryland and continue their preservation.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

The treatment of lands in the watershed with land treatment measures essential for the conservation, utilization of soil and disposal of water is the purpose of the land treatment portion of the works of improvement.

The measures considered for this watershed are those necessary to assure the realization of the benefits used in the justification of the planned stream channel improvements. The cropland practices to be accelerated during the project period include drainage mains and laterals, cover and green manure crops, crop residue use, ditch bank seeding, and conservation cropping systems.

Drainage mains and laterals are the basic elements of the land treatment program, since they extend the water disposal benefits from the group outlets to the private farms. Tile drains may be used as a supplemental measure where soils are suitable. Land smoothing will be employed where the fields are suitable and the practice is acceptable to the landowner.

The agronomic practices included are related primarily to maintaining the soil tilth and preventing surface sealing as well as contributing to the maintenance of soil organic matter and preventing erosion. These practices also contribute to flood prevention through improved hydrological conditions of the soil. Pasture management will be used to treat the pastureland.

Wildlife habitat management measures such as planting useful shrubs and grasses in odd areas and timing ditchbank mowing so as not to disturb nests will be used to improve the huntable quail and rabbit resource in the area. Landowners will also be assisted in installing ponds and shallow water impoundments for waterfowl.

Under the accelerated program, technical assistance will be provided to the landowners cooperating with the Wicomico, Somerset and Worcester Soil Conservation District to develop about 160 conservation plans and apply land treatment measures to 2,540 cropland and 43 acres of pastureland during the project installation period. Additional technical assistance will be provided under the going program throughout the life of the project. Technical assistance for wildlife management will also be provided by the Maryland Department of Natural Resources, Fish and Wildlife Administration.

Hydrologic cultural operations will be installed as land treatment measures on forest lands. These forestry practices will improve hydrologic conditions which, in turn, will reduce sedimentation and facilitate ground water recharge.

Well managed and protected forest cover produces litter from which the humus layer develops. This, in turn, protects the soil and increases infiltration and percolation rates and water storage capacity.

To insure adequate and proper woodland treatment along with maximum watershed protection, private woodland owners will be provided with technical assistance for installing measures affecting 700 acres of forest land. Technical assistance will also be used for:

1. Preparing 60 woodland management plans, involving 1,800 acres, which will outline practical measures to be applied in the immediate future to maintain and improve the hydrologic conditions of forest land. The management plan will take into consideration the needs and desires of the landowner and will provide recommendations that will enhance the multiple use values of the forested area such as recreation, wildlife, timber, and any other use that might be important to the owner.
2. Stimulating landowner interest for participating in the watershed program.
3. General planning, supervision and inspection of the program.

The Maryland Department of Forests and Parks will install needed soil and water conservation measures on Pocomoke State Forest as part of the going land management program. The planned program includes 350 acres of tree planting and 440 acres of hydrologic cultural operations.

Structural Measures

The structural measures consist of approximately 87.0 miles of multiple-purpose channel improvements for the conveyance, control and disposal of excess drainage and floodwaters of the watershed.

The system of channels includes three construction units consisting of (1) the Upper Dividing Creek system (including Upper Dividing, Pusey and Pollitts Branches) approximately 60.4 miles; (2) the lower Worcester County tributaries approximately 6.6 miles; and (3) lower Somerset County tributaries approximately 20.0 miles. The construction schedule will provide for completion of the construction and land treatment within seven calendar years.

The minor tributaries will provide direct measurable benefits to two or more beneficiaries. The main and major prongs of tributaries are located schematically on the project map and their design details are shown in Table 3A. The minor tributaries are described and located in more detail in the basic data for this work plan.

Recent observations and study indicate that channels built under conditions of topography, soils and hydraulic dimensions, similar to those proposed, function without significant degradation of the channel bed. Aggradation of channel bottoms from the deposition of sediment and vegetative material has historically depleted channel cross-sections and created maintenance problems. The planned stabilization and erosion control measures along with a proper maintenance program will minimize in-bank deposition and insure proper channel functioning during the project life. The designed water surface varies from overbank flow in swamped areas to from 6 inches to one foot below ground surface in agricultural lands.

The structural measures, i.e., stream channel improvement, include certain appurtenances needed for the protection of the channel or to protect other structures affected by the channel improvements. These features include controlled inlets, pipe drops and grade stabilization measures at critical points along the channels. Where applicable, culverts or pipes will be used to provide for channel maintenance and access crossings as well as outlets for side drainage and channel protection. An estimate of the number and cost of these measures is included in the basic data for the plan. To preserve forest land and wildlife habitat, clearing in the woodland areas will be kept to a minimum. Side slopes of the channel will be seeded daily immediately following any construction work. Following completion of construction on each unit, areas without well established vegetation will be reseeded. This will result in a total seeding of 70 acres in cropland areas, including an 8-foot strip on each side of the channels, and 412 acres, the total right-of-way, in woodland areas to stabilize the channel improvements and reduce erosion and further maintenance. Valuable food and cover plants for quail, rabbits and other wildlife will be included in the seeding mixtures. The seeded rights-of-way through the woodland will create more new habitat for open-land wildlife than will be damaged by destroying the brushy growth along existing ditches in the cropland.

Acceptable solutions to the mitigation of wetland drainage in this watershed have been worked out jointly by the Department of Natural Resources, the sponsors and the Soil Conservation Service. The solution on Pusey Branch is to construct the proposed channel improvements to the west side of the wetland area and provide a continuous levee on the wetland side adjacent to the channel. A weir and a battery of four pipes at the upstream end of the diversion will allow for a flow approximately equal to the annual March ten day low flow in the natural channel. Excess flows will use the constructed channel as well as the natural channel. A battery of 4 - 24" pipes and a head wall will be installed in the natural channel where it enters the downstream end of the constructed channel, which is 2 feet lower in grade, to prevent raveling of the natural channel. The by-pass channel will begin at the lower control structure, approximately 200 feet upstream of Old Furnace Road, and extend approximately 3 miles upstream to the upper control structure which is just above the head of the wooded swamp. The control structures and levees will provide for normal flows over the wooded wetlands. The constructed channel will end approximately 750' downstream from Old Furnace Road. A sediment basin will be provided at the lower end to collect sediment and debris.

On Main Dividing Creek the beginning of the proposed channel improvement begins approximately 2.0 miles upstream of Denston Dam Road. A sediment basin will be provided at the lower end of the construction to collect sediment and debris.

On Pollitts Branch and Prong I, Unit II, and other major tributaries, the channel improvements will be constructed along the edge of wooded areas and will include levees wherever practical and feasible. Sediment basins will be constructed as needed.

In order to protect the anadromous fish run from damaging turbidity, excavation work, except clearing during the period of March 15th through June 15th may proceed only with the concurrence of the Maryland Department of Natural Resources.

Approximately 108 pipes or culverts at road and highway crossings will require enlargement, replacement or lowering to provide adequate capacity and the proposed design grade. These include an estimated 74 by the Counties, 4 by the State Roads Commission, and 30 by private landowners. These costs (\$55,275) are a part of the land rights to be furnished at no cost to the Federal Government. The total estimated cost of the proposed multiple-purpose channel measures, including construction costs, engineering services, land rights, and project administration is \$1,218,069. The average annual cost, including the cost of operations and maintenance is \$79,500.

EXPLANATION OF INSTALLATION COSTS

The costs of applying land treatment will be borne by the landowners and operators with assistance made available by the Agricultural Conservation Program. These costs were based on combinations of essential conservation measures grouped according to the soil capability and needs. Current expenditures for such measures were the basis for cost estimates with custom rates for particular practices used as guides. Soil Conservation Service technical assistance costs were based on amounts of time and personnel required to provide assistance for planning and application of the essential land treatment. PL-566 funds will be provided to accelerate the going conservation program in the watershed.

Costs for the installation of forest land treatment measures are based on current costs of supervision, labor, equipment and materials needed to perform the particular measures on both private and State land.

Costs of technical assistance for the installation of forest land treatment measures on private land are based on actual expenditures and accomplishments of the Maryland Department of Forests and Parks, and will be shared by the State and Federal Governments. An analysis of costs against accomplishments was made for each measure to determine unit costs for technical assistance.

The structural measures costs were based on 1969 prices. A 12 percent contingency was added to cost estimates for the stream channel improvements. Unit prices were established from bids for contracts recently awarded. The construction costs include clearing, excavation, spoil disposal, seeding costs for the channel improvements, and installation of stream channel appurtenances and controls. The estimated cost of the stream channel appurtenances and controls and the estimated cost of seeding the stream channel improvements is based on bids for contracts recently awarded.

Engineering services costs include the costs of providing the engineering services needed to install the structural measures. Engineering services for the channel improvements are based on an established per mile cost.

Project administration costs are based on percentages of construction costs which have been developed to estimate overhead costs, administration of contract costs and other similar services costs.

Land rights for the channel improvements are based on the land values of the woodland and the crop income loss due to construction in cropland during the cropping season. The costs of relocating highway and road pipes and culverts, a land rights cost, are based on the amount of labor and materials required.

Administration of contract costs represent the value of administration, legal and clerical services to be provided by the contracting local organization. These costs were lump sum estimates based on the size and complexity of the job.

The total installation costs of the channel improvements, including mitigation measures, are joint flood prevention and agricultural water management costs. Therefore, 50 percent of the cost was allocated to flood prevention and 50 percent to drainage. Public Law 566 will bear 75 percent of the construction costs and 100 percent of the engineering services costs. Other funds will bear 25 percent of the construction costs and 100 percent of the land rights costs. Project administration costs will be borne by PL-566 and other funds. PL-566 funds will bear the cost of project administration required or performed by the Soil Conservation Service including construction inspection, administration, and overhead costs. Other funds will bear the cost of project administration required or performed by the sponsoring organizations including construction inspection and supervision, contract administration and overhead expense.

Table 2A shows a summary of the cost allocation and cost sharing.

The following table shows the schedule of fund obligations during the project period:

<u>Project Period</u> <u>(Years)</u>	<u>PL-566</u>		<u>Other</u>	
	<u>Land</u> <u>Treatment</u>	<u>Structural</u> <u>Measures</u>	<u>Land</u> <u>Treatment</u>	<u>Structural</u> <u>Measures</u>
1st	7,142	227,421	20,065	172,807
2nd	22,243	294,360	51,381	69,656
3rd	22,843	130,330	53,281	50,157
4th	23,343	192,720	55,981	52,125
5th	23,843	24,298	57,581	2,000
6th	23,343	-	55,981	-
7th	13,884	-	34,530	-

EFFECTS OF THE WORKS OF IMPROVEMENT

The reduction of floodwater damages and more favorable soil moisture conditions will lead to increased net income for farm families in the watershed. Floodwaters from normally high precipitation and out of bank flow will be removed from the drainage area at a desired rate with the stream channel improvements installed. Control of the water table during the critical planting and harvest seasons will create soil moisture conditions contributive to seed germination, plant growth and the ability to get modern heavy farm machinery on the fields at desired times. Crop production will be more dependable with the project installed. Sporadic crop production restricts diversification and has limited the area to the production of truck cash grains. With stable production and proper soil moisture conditions, income from crop production will become more prominent in the watershed.

Feed grains produced in the watershed are processed by local feed mills to supply the poultry industry of the Delmarva Peninsula. This industry is expected to expand by about 25 percent by 1975.

Reduced production costs of particular crops, improved crop quality, land use changes and increased productivity will be the effects contributing to increased farm income. The improved channels will make application of improved management and conservation practices to all the cropland practical. The effects will extend beyond the benefit area since parts of some fields have soils lacking excess water hazards. It is not practical to treat these soils separately. The minimum benefit area is at least 14,000 acres of cropland, pasture, and forest land.

The quality of crops grown on soils with water problems is usually sharply increased as a result of control of excess water. This is reflected in reduced disease, less insect damage, better weed control, and better curing. The grade of a farm's entire production will frequently be lowered by crops grown in wet spots. This has been particularly significant in the soybean markets of the peninsula.

The project will bring about more efficient use of land, labor, and capital by reducing flood hazards and improving on-farm drainage. Farmers in the watershed are using sufficient management practices and materials to realize better than average yields. These yield levels are reduced by 25 to 50 percent during years when flood damages are high and the water table is high. With the project, stable yields will enable the farmers to realize a profit from the committed factors of production. The average annual increased net returns for each of the 340 farms is estimated to be \$610 with the project. Remaining floodwater damage per farm will be \$45 annually. Changed land use involving 219 acres of idle land will provide \$6,467 in benefits annually as a result of the project. Other project benefits (flood prevention and drainage) will accrue on existing cropland.

The impact of the proposed drainage upon the need for increased forest fire protection has been analyzed. Even though drainage will increase the forest fire hazard, the channel access roads will be available for

fire access and present fire control facilities will provide adequate protection after drainage.

The proposed forest land treatment measures will improve the hydrologic condition of the woodland. This in effect will increase infiltration and percolation rates and will reduce sedimentation. Adequate fire protection and the multiple use management of the forest land resources will increase the benefits from water, recreation, and fish and wildlife in addition to timber production. Good forest management and fire protection will be an added increase to the productivity of the forest land on the watershed.

In addition to farm interests, benefits will accrue to suppliers of goods and services used in the production and harvest of farm products, through increased sales brought about by the improved soil conditions and increased crop production.

Similarly, the general public will benefit by maintenance of the tax base as a result of higher land values with the project installed. The project installation will tend to encourage non-agricultural improvements in the watershed since water management problems are not limited to agriculture. The rural community will realize immediate benefits, incidental to the agricultural purposes of the project, by the disposal of excess water. County and state roads will also receive similar benefits. It is estimated that road maintenance costs will be reduced 15 percent with the project. The monetary value of the above benefits were not included in the work plan.

Effects detrimental to wildlife and the natural environment of this project has been minimized through close cooperation with the Maryland Department of Natural Resources. Along the channel, 3.8 miles (approximately 210 acres out of 3,400 acres in the watershed) of the upper reaches of the wooded swamp will be effected. Only .8 miles, approximately 20 acres, will be seriously effected. Mitigation measures described under "Structural Measures" will eliminate most damages to the remainder and in some cases will improve them as wetlands.

Sediment traps to be constructed at the lower ends of all construction sections will eliminate any serious downstream sedimentation. After construction, these sediment basins will, as will the channel bottoms, provide valuable waterfowl feeding and resting habitat which in other areas has provided increased hunting opportunity. The basins may also provide a limited fishery area. Immediate seeding of the channel banks at the construction shutdown period during the spring will prevent serious damages resulting from turbidity to anadromous fish runs in lower reaches of the stream.

Clearing brushy growth along ditch in the cropland will destroy wildlife cover. However, the permanent seeding of an eight foot grass strip along the constructed ditches will provide valuable feeding and nesting areas for quail and rabbits. Clearing and seeding of the 345 acres of woodland right-of-ways increase the habitat in the watershed for quail, rabbits and other upland wildlife. Valuable wildlife food and cover species

included in the seeding mixtures will be a valuable addition to the habitat. Total seeding costs are estimated to be \$78,389. Land treatment measures for upland wildlife and waterfowl will also improve the lot of game and non-game animals and birds in the watershed.

The watershed area is approximately 65.5 square miles, the proposed channel improvements are located in an area of 29.1 square miles or approximately 44 percent of the upper reaches of the watershed. The main stem channel improvements begin approximately 12 miles upstream of the confluence of Dividing Creek and the Pocomoke River. Thus, there are approximately 12 miles of natural channel and flood plain in the lower part of the watershed to act as a buffer zone.

Water surface profiles were developed for varying stages of flow with and without project and show there is no induced flooding in the lower reaches of the Dividing Creek Flood Plain. The flood plains become more entrenched in the downstream reaches and serve as natural storage basins that dissipate any increased flood peaks from the proposed upstream improvements. Engineering studies indicate there will be no induced flooding in the lower reaches nor noticeable effect at the confluence with the Pocomoke River.

PROJECT BENEFITS

The project benefits include primary and local secondary benefits. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation. The average annual benefits total \$192,299 and are shown in Table 6.

The average annual primary benefits accruing jointly to the multi-purpose channel improvements total \$165,573 of which \$159,106 is attributed to damage reduction and increased yields and \$6,467 from changed land use.

Local secondary benefits stemming from the project and induced by the project total \$26,726. The benefits stemming from the project of \$16,557 are based on primary benefits and include the increased returns from transportation, marketing, and processing of the increased farm production with the project. The secondary benefits induced by the project of \$10,169 are based on increased production costs which result in increased returns from the sale of production materials and services and the increased economic activity in the watershed.

COMPARISON OF BENEFITS AND COSTS

The structural measures described in this work plan are economically justified. The average annual project benefits total \$192,299 and include primary benefits of \$165,573 and secondary benefits of \$26,726. The total annual cost of the structural measures is \$79,500. The ratio of annual primary benefits to the annual cost is 2.1 to 1.0. The ratio of total annual benefits to annual costs is 2.4 to 1.0. The annual benefits and costs are compared in Table 6.

PROJECT INSTALLATION

Land Treatment Measures

Due to the need for adequate outlet channels, acceleration of the application of land treatment will follow the installation of the stream channel improvements. During the first year of the project period, the land treatment program will be virtually limited to servicing new district co-operators and conservation planning. Application of land treatment on an accelerated basis will commence in the second project year when the channel improvements on Unit I are well underway. By this time, the planning will be about completed and the land treatment operations will be concentrated on application in the watershed.

The land treatment will be installed by the landowners and operators under agreement with the Worcester, Wicomico and Somerset Soil Conservation Districts. The Soil Conservation Districts will provide evidence prior to the installation of the structural measures that a high percentage of the landowners and operators to be benefited by the structural measures will agree to the development of basic plans.

Technical assistance for the preparation of farm plans will be furnished by the Soil Conservation Service cooperating with the Worcester, Wicomico and Somerset Soil Conservation Districts. The Soil Conservation Service will provide leadership and liaison responsibilities in assisting landowners and operators, individually and in groups, establish income-producing recreation enterprises on rural non-Federal land. The Fish and Wildlife Administration will also assist landowners in evaluating and improving wildlife habitat in the watershed.

Forestry measures will be installed by the landowners with technical assistance furnished by the Maryland Department of Forests and Parks in cooperation with the U. S. Forest Service. Treatment measures under the going program on Pocomoke State Forest will be borne entirely by the Maryland Department of Forests and Parks. The Somerset, Wicomico and Worcester Forestry Boards and the Soil Conservation Districts will cooperate with the Department of Forests and Parks in the promotion and encouragement of sound forestry practices in the watershed.

Other agencies, including the Maryland Extension Service, the Maryland Fish and Wildlife Administration, the Farmers Home Administration, and the County Agricultural Stabilization and Conservation Committee, will provide their services and support to the establishment of the land treatment measures and the project as a whole.

Local newspapers will be used to disseminate information about the land treatment and structural phases of the project. Notification of specific meetings and particular items of information will be supplied to the landowners through the mail by the agencies assisting in the installation of the project.

Structural Measures

The structural measures consist of approximately 87.0 miles of multiple-purpose channel improvements. The system of channels includes three construction units consisting of Unit I, the Upper Dividing Creek system (including Upper Dividing, Pusey and Pollitts Branches approximately 60.4 miles); Unit II, the lower Worcester County tributaries approximately 6.6 miles; and Unit III, lower Somerset County tributaries approximately 20 miles. These units are expected to be constructed in the order listed and according to the construction schedule shown on Page 14. The necessary land rights for construction of the multiple-purpose channel systems will be acquired by public drainage associations. The present sponsoring organizations have all the needed power to obtain such land rights, but will carry out their responsibilities under other State Laws by organizing public drainage associations which will become sponsors of the project.

The preparation, award, and administration of contracts will be under the direction of a contracting officer appointed by the local contracting organization, the public drainage association, hereinafter referred to only as the Association. The governing body of the Association will enter into a contract for the works of improvement by competitive bid procedures. The authority of the public drainage association is described in Article 25 of the Annotated Code of Maryland (1957). The Maryland State Roads Commission and Worcester, Wicomico and Somerset Counties Roads Department will improve, construct and maintain necessary bridges and culverts planned for the project as requested by the governing body of the Association.

In carrying out their responsibilities, the Worcester and Somerset Counties Commissioners and Wicomico County Council will advise the viewers and the Association that the channel layout included in the supplemental data and as agreed to during preliminary viewing, will be the basis for PL-566 cost sharing except for minor variations of alignment and relocation of minor tributaries because of changed ownership and land use.

The State Drainage Engineer for Maryland, in discharging his duties pertaining to the functioning of the Associations will provide the necessary coordination of channel layout in order to meet project objectives, maintain the basis of economic evaluation and assure establishment of the project essentially as presented and recommended by the Steering Committees at the time of preparation of the plan.

Assistance for such coordination will be provided by the local Soil Conservation Service Offices and the Extension Agents, as needed.

The Soil Conservation Service will provide the engineering services necessary for installation of the structural measures included in the work plan. Technicians will be provided to assist in the final surveys and design for project installation. Project administration performed by the Soil Conservation Service will include construction inspection, certification of payment and related duties, and the preparation of specifications for use by the local contracting organization in the letting of contracts.

The sponsoring local organization will bear project administration costs associated with project installation including the letting and administering of the contracts and supervision of construction by a local contracting officer, overhead expense, and necessary construction inspection to satisfy their needs.

FINANCING PROJECT INSTALLATION

Land Treatment

The total estimated cost of the land treatment is \$465,440; PL-566 will bear \$136,640 of this cost for technical assistance and \$328,800 will be borne by other funds. The cropland and pasture treatment is estimated to cost \$360,140. The portion of this cost for accelerated technical services to be borne by PL-566 is \$120,840. The other cost of \$239,300 includes \$197,930 landowner costs, with assistance from the Agricultural Conservation Program for installation of conservation measures and \$41,370 technical services costs from the going conservation program. Loans are available for soil and water conservation purposes from the Farmers Home Administration.

The total cost of installing forest land treatment measures is estimated to be \$105,300. Technical assistance to woodland owners for the installation of these measures will cost \$18,800 and will be provided as follows: PL-566 - \$15,800; Maryland Department of Forests and Parks - \$3,000. The remaining \$86,500 includes \$53,000 as installation costs to the private landowners, \$6,3000 contributed by the Maryland Department of Forests and Parks toward the cost of tree seedlings furnished to landowners, and \$27,200 for installing land treatment measures on Pocomoke State Forest. It is expected that Agricultural Conservation Program cost sharing will be available to qualified landowners installing these measures.

Structural Measures

A substantial part of the costs of the structural measures will be borne by non-federal sources. These include 25 percent of the contract cost of the multiple-purpose channels and appurtenances, 100 percent of the cost of the land rights, including relocation of facilities and 100 percent of the cost of administration of contracts. The County Commissioners, Council and the Associations will share the local contract costs with the County Commissioners and the Council contributing a portion of the local cost. In addition, the counties will furnish approximately \$35,325 to replace county pipes and culverts requiring alteration. These organizations have adequate taxing authority and previous experience gained indicates the feasibility of the system in operation. The Associations will provide all the needed land rights for the multiple purpose channel program. The Dividing Creek Public Drainage Association will finance their part of the project costs with a PL-566 loan administered by the Farmers Home Administration. Pending the legal formation of the Association, the County Commissioners and Council, in the interim, have filed an application for a loan for the Public Drainage Association. This Association, when legally formed, will execute an agreement for repayment of the loan with F.H.A. before a project agreement is executed. Funds for the repayment of the loan will become a budgeted item in the Association budget.

Public Law 566 funds will provide 75 percent of the construction costs of the multiple-purpose channels, and 100 percent of the engineering services costs. The Service and the Sponsors will each bear the cost for project administration they incur.

Federal assistance to the local organization is contingent upon approval of the plan by the State and the Soil Conservation Service. This work plan does not constitute a financial document for the obligation of federal or other funds. Financial and other assistance to be furnished by the Soil Conservation Service in carrying out the Watershed Work Plan is contingent upon the annual appropriation of funds for the installation of watershed protection and flood prevention projects.

The estimated costs, by funds are included in Tables 1 and 2. Details and breakdown of these costs are included in the supplemental data.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land Treatment Measures will be operated and maintained by the landowners or operators of the farms on which the measures are installed, under agreements with the Worcester, Wicomico and Somerset Soil Conservation Districts. The District will make periodic inspections of the land treatment measures to determine maintenance needs, will encourage the landowners and operators to perform maintenance and will make District-owned equipment available for this purpose.

The forest land treatment measures will be on private land maintained by landowners with technical assistance provided by the Maryland Department of Forests and Parks in cooperation with the U.S. Forest Service through the Cooperative Forest Management Program. The Maryland Department of Forests and Parks will maintain forest land treatment measures on Pocomoke State Forest.

Structural Measures

The approximately 87.0 miles of channel improvement will be operated and maintained by the sponsors and the governing body of the Associations. Maintenance will be performed by equipment rental or force account procedures. The annual operation and maintenance cost of the structural measures is estimated to be \$14,042 for the channel improvements. The sponsors will assume responsibility for providing adequate operation and maintenance funds. These funds are to be raised through taxation by the Association, and contributions made available by the County Commissioners and Council.

The sponsors and the Service will jointly make annual inspections to determine maintenance needs during a three year establishment period. More frequent inspections will be made if unusual conditions prevail. A record will be kept of all maintenance inspections. After the third year, inspections will be made annually by the sponsors and a report furnished to the Service.

An acceptable operation and maintenance plan, prepared and included as a part of the operation and maintenance agreement, will be executed prior to issuance of invitations to bid. The operation and maintenance plan and agreement will provide for the annual operation and maintenance. The Service will participate in maintenance to the extent of (1) furnishing technical assistance to aid in the inspection, (2) furnishing technical design information necessary for the maintenance program, (3) technical assistance to aid in the development and revision of operation and maintenance plans. Maintenance includes, but is not limited to, such measures as mowing, brush control, stabilizing, fertilizing and reseeding critical areas, bar removal, debris removal, structure maintenance, stabilization measures and keeping access roads for maintenance and associated pipes in good condition and maintenance of an 8 foot wide strip along the channels, cropland and vegetation in woodland. The Maryland Fish and Wildlife Administration will make technical recommendations on management.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COSTS

Dividing Creek Watershed, Maryland

		Number Estimated Cost (Dollars) ^{1/}			
		Non-Fed	PL-566	Other	Total
Installation Cost Item	Unit	Land	Funds	Funds	Funds
<u>LAND TREATMENT</u>					
Soil Conservation Service					
Cropland	Ac.	2,540	-	197,370	197,370
Pasture	Ac.	43	-	560	560
Technical Assistance			120,840	41,370	162,210
SCS Subtotal			120,840	239,300	360,140
Forest Service					
Forest Land	Ac.	2,590	-	86,500	86,500
Technical Assistance			15,800	3,000	18,800
Forest Service Subtotal			15,800	89,500	105,300
TOTAL LAND TREATMENT			136,640	328,800	465,440
<u>STRUCTURAL MEASURES</u>					
<u>Construction</u>					
Soil Conservation Service					
Stream Channel Improvement	Mi.	87.0	543,248	181,085	724,333
Subtotal - Construction			543,248	181,085	724,333
<u>Engineering Services</u>			98,120	-	98,120
Soil Conservation Service					
Subtotal - Engineering			98,120	-	98,120
<u>Project Administration</u>					
Soil Conservation Service					
Construction Inspection			142,720	-	142,720
Other			87,237	13,000	100,237
Subtotal - Administration			229,957	13,000	242,957
<u>Other Cost</u>					
Land Rights				152,659	152,659
Subtotal - Other				152,659	152,659
TOTAL STRUCTURAL MEASURES			871,325	346,744	1,218,069
TOTAL PROJECT			1,007,965	675,544	1,683,509
<u>SUMMARY</u>					
Subtotal SCS			992,165	586,044	1,578,209
Subtotal FS			15,800	89,500	105,300
TOTAL PROJECT			1,007,965	675,544	1,683,509

^{1/} Price Base 1969

August, 1970

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Dividing Creek Watershed, Maryland

Measures	Unit	Applied to Date	Total Cost (Dollars) ^{1/}
LAND TREATMENT			
Soil Conservation Service			
Conservation Cropping System	Ac.	3,390	-
Crop Residue Use	Ac.	3,060	\$ 4,603
Drainage Mains & Laterals	Ft.	169,116	67,646
Pasture Management	Ac.	10	115
Forest Service			
Hydr. Cultural Operation	Ac.	1,220	73,200
Fire Control	Ac.	34,436	32,000
TOTAL:			\$177,564

^{1/} Price Base 1969

August, 1970

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Dividing Creek Watershed, Maryland

(Dollars)^{1/}

Item	Installation Cost PL-566 Funds			Installation Cost - Other Funds			Total Installation Cost
	Construction	Engineering	Total PL-566	Construction	Land Rights	Total 2/ Other	
Channel Improvement							
Upper Dividing Creek	400,376	68,860	469,236	133,460	119,503	252,963	722,199
Lower Worcester	33,961	7,260	41,221	11,321	8,277	19,598	60,819
Lower Somerset	108,911	22,000	130,911	36,304	24,879	61,183	192,094
Sub-Total	543,248	98,120	641,368	181,085	152,659	333,744	975,112
Project Administration							
			229,957			13,000	242,957
GRAND TOTAL	543,248	98,120	871,325	181,085	152,659	346,744	1,218,069

^{1/} Price Base 1969

^{2/} Includes \$55,275 for road pipes and culverts.

August 1970

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Dividing Creek Watershed, Maryland

(Dollars)^{1/}

Cost Allocation		Cost Sharing					
		PL-566			Other		
Item	Purpose	Flood Prevention		Drainage		Total	
		Drainage	Total	Flood Prevention	Drainage	Flood Prevention	Total
Multiple Purpose Channel	487,554	487,558	975,112	411,226	230,142	76,328	333,744
GRAND TOTAL	487,554	487,558	975,112	411,226	230,142	76,328	333,744

^{1/} Price Base 1969

TABLE 3A - STRUCTURE DATA

CHANNEL

Dividing Creek Watershed, Maryland

Channel (No. or Name)	Sta. or Reach	Drainage Area Sq. Mi.	Capacity		Hydraulic Gradient		Channel Dimensions		"N" Value Aged As Built	Velocities		Excava- tion (1000) Cu.-Yd.	Type of Improve- ment ^{2/}
			Req'd	Design	(Ft/Ft)	Bottom	Depth	Sides ^{1/} (Ft) Slopes		3/Aged	As Built		
Upper Dividing Dividing Main	800+00	9.0	230	229	.00014	50	3.8		.035	1.12	3.04	16.4	C E
	832+70	6.8	182	182	.00010	40	4.2		.035	0.98	3.06	10.5	C E
	846+80	6.8	182	183	.00011	40	4.1		.035	1.01	3.06	5.0	C E
	853+20	5.8	158	158	.00011	35	4.0		.035	1.01	3.05	1.3	C E
	855+44	5.8	158	161	.00054	17	3.9		.035	2.00	3.22	12.4	C E
	880+80	5.0	145	148	.00054	16	3.8		.035	1.97	3.29	3.6	C E
	890+70	3.7	109	109	.00053	12	3.8		.035	1.85	2.98	3.6	C E
	904+49	3.7	109	107	.000485	12	3.8		.035	1.79	2.98	1.5	C E
	910+00	2.8	88	87	.00058	10	3.8		.040	1.66	2.89	0.8	C E
	914+00	2.8	88	91	.0011	7	3.9		.040	2.15	4.42	9.3	C E
Prong No. 4	955+00	1.4	54	57	.0011	7	3.0		.040	1.89	4.01	6.8	C E
	0+00	0.9	46	56	.0024	4	3.1		.040	2.55	5.05	2.1	C E
	20+00	0.8	46	46	.002	4	2.9		.040	2.29	4.98	0.4	C E
	23+00	0.3	19	23	.0021	4	2.0		.040	1.93	4.66	0.6	C E
	28+00	0.3	17	17	.0025	4	1.6		.040	1.90	4.66	0.5	C E
	32+00	0.2	15	27	.005	4	1.7		.040	2.75	4.61	0.8	C E
	39+00	0.2	12	12	.001	4	1.7		.040	1.25	2.57	2.5	C E
	0+00	1.3	49	54	.001	4	3.8		.040	1.83	3.58	1.6	C E
	8+00	1.2	49	50	.0013	4	3.4		.040	2.00	4.06	5.3	C E
	37+00	0.4	27	27	.0006	4	3.0		.040	1.27	2.67	2.9	C E
Prong No. 5	58+00	0.3	17	17	.0005	4	2.5		.040	1.05	2.69	2.1	C E
	0+00	0.8	37	39	.0005	4	3.8		.040	1.31	2.56	1.6	C E
	8+00	0.7	37	37	.0017	4	2.7		.040	2.04	4.28	5.5	C E
	41+00	0.2	15	16	.00065	4	2.2		.040	1.14	2.45	2.8	C E
	0+00	0.8	37	39	.0005	4	3.8		.040	1.31	2.56	1.6	C E
	8+00	0.7	37	37	.0017	4	2.7		.040	2.04	4.28	5.5	C E
	41+00	0.2	15	16	.00065	4	2.2		.040	1.14	2.45	2.8	C E
	0+00	0.8	37	39	.0005	4	3.8		.040	1.31	2.56	1.6	C E
	8+00	0.7	37	37	.0017	4	2.7		.040	2.04	4.28	5.5	C E
	41+00	0.2	15	16	.00065	4	2.2		.040	1.14	2.45	2.8	C E

1/ All Channel Side Slopes are 1:1.

2/ D B - Desilting Basin

C E - Channel Enlargement

3/ As Built "N" Value .025.

4/ As Built Velocities are based on bank full flow or
"A" drainage curve capacity, whichever is less.

August 1970

TABLE 3A - STRUCTURE DATA

CHANNEL

Dividing Creek Watershed, Maryland

Channel (No. or Name)	Sta. or Reach	Drainage Area Sq. Mi.	Capacity		Hydraulic Gradient (Ft/Ft)	Channel Dimensions		"N" Value Aged As Built ^{3/}	Velocities		Excava- tion (1000) Cu.-Yd.	Type of Improve- ment ^{2/}
			Req'd	CFS		Bottom (Ft)	Depth (Ft)		As Built ^{4/}	As Built ^{4/}		
Prong No. 7	0+00	21+00	47	47	.0005	5	3.9	.040	1.36	2.39	3.2	C E
	21+00	49+00	26	26	.0005	4	3.1	.040	1.18	2.63	3.6	C E
	49+00	57+00	21	24	.0005	4	3.0	.040	1.14	2.79	1.2	C E
	57+00	81+00	18	18	.0005	4	2.6	.040	1.07	2.49	3.0	C E
Middle Dividing												
Prong No. 3	57+00	86+00	116	114	.0004	24	3.0	.040	1.39	2.02	6.8	C E
	86+00	106+00	101	101	.0005	20	3.0	.040	1.47	2.53	5.9	C E
	106+00	126+00	77	78	.0006	14	3.0	.040	1.53	2.73	5.7	C E
	0+00	43+32	101	101	.00077	14	3.2	.040	1.83	3.75	3.6	C E
Pollitts Main	43+32	47+32	93	93	.00093	12	3.2	.040	1.95	4.10	0.2	C E
	47+32	67+54	93	93	.0012	12	2.9	.040	2.15	3.72	2.3	C E
	67+54	71+32	83	83	.00053	12	3.5	.040	1.56	3.64	0.6	C E
	71+32	103+95	83	83	.00092	12	3.0	.040	1.88	4.14	5.8	C E
	103+95	118+00	69	71	.00066	12	3.0	.040	1.60	2.76	2.6	C E
	118+00	185+61	69	68	.00044	12	3.3	.040	1.37	2.74	15.6	C E
	185+61	201+65	40	40	.00044	6	3.4	.040	1.26	2.46	2.2	C E
	201+65	245+00	32	32	.000374	6	3.1	.040	1.13	2.28	3.9	C E
	245+00	250+95	32	32	.0009	6	2.5	.040	1.52	3.82	0.7	C E
	250+95	262+98	32	32	.0018	4	2.5	.040	2.02	3.64	0.6	C E
Prong No. 1	0+00	5+50	9	10	.005	4	1.0	.040	2.12	3.92	0.6	C E
	5+50	13+00	8	10	.0025	4	1.2	.040	1.64	3.07	0.8	C E
	13+00	19+00	7	9	.0015	4	1.3	.040	1.33	2.53	0.7	C E
	19+00	27+00	6	6	.0007	4	1.3	.040	0.92	1.90	0.7	C E
Prong No. 2	0+00	0+40	8	8	.0005	4	1.6	.040	0.86	1.57	0.1	C E
	0+40	4+15	8	14	.0065	4	1.1	.040	2.55	4.73	0.5	C E
Prong No. 3	0+00	15+25	18	19	.0004	4	2.8	.040	1.01	2.14	3.0	C E
	15+25	33+00	11	11	.0004	4	2.1	.040	0.88	2.34	3.4	C E
S-1 of 3	0+00	3+00	3	5	.001	4	1.0	.040	0.95	4.43	0.4	C E
	3+00	13+00	3	4	.0008	4	1.0	.040	0.85	1.99	0.8	C E

TABLE 3A - STRUCTURE DATA

CHANNEL

Dividing Creek Watershed, Maryland

Channel (No. or Name)	Sta. or Reach	Drainage Area Sq. Mi.	Capacity CFS	Hydraulic Gradient (Ft/Ft)	Channel Dimensions Bottom Depth (Ft) Sides (Ft)	"N" Value Aged As Built ³	Velocities Aged As Built ³	Excava- tion (1000) Cu.-Yd.	Type of Improve- ment ⁵
Pollitts Main Prong No. 4	0+00 8+00	0.2	12	21	4	2.8	1.11	2.52	1.3
Pusey Main	209+23 211+73	10.3	258	.00042	80	5.5	1.65	2.66	2.3
	211+73 230+08	10.3	258	.00054	50	3.0	1.65	2.72	6.8
	230+08 232+00	10.2	256	.00041	50	2.9	1.65	2.72	16.6
	232+00 264+15	10.2	226	.00050	44	2.8	1.75	2.70	17.5
	264+15 290+15	9.3	207	.00054	44	2.8	1.72	2.70	11.9
	290+15 297+85	8.7	192	.00054	42	2.8	1.58	2.68	3.2
	297+85 321+90	8.3	186	.00053	42	2.6	1.55	2.79	14.6
	321+90 396+15	7.6	169	.00054	40	2.4	1.53	3.03	47.5
	396+15 399+09	5.6	154	.00055	30	2.9	1.60	3.08	2.2
	399+09 403+04	5.0	141	.00055	28	2.9	1.59	2.60	2.1
	403+04 417+46	4.0	116	.00055	23	2.9	1.56	3.03	5.1
	417+46 428+62	3.8	112	.00055	22	2.9	1.55	3.06	3.6
	428+62 442+69	3.6	107	.00055	21	2.9	1.54	3.04	5.1
	442+69 464+21	3.4	102	.00052	20	3.0	1.50	3.02	7.1
	464+21 487+34	3.2	102	.00044	20	3.1	1.42	2.85	3.9
	487+34 521+26	1.7	63	.0004	14	3.0	1.26	2.38	6.4
	521+26 525+51	1.3	63	.0004	14	3.0	1.26	2.55	0.5
	525+51 550+07	0.8	38	.00045	8	3.0	1.21	2.37	2.5
	550+07 551+18	0.6	32	.00028	8	3.0	0.97	2.30	0.8
	551+18 567+06	0.6	32	.00078	6	2.7	1.47	3.18	2.3
	567+06 576+42	0.5	27	.00108	4	2.6	1.60	2.97	0.8
Prong No. 1	576+42 579+35	0.4	27	.000875	4	2.7	1.48	3.01	2.5
	579+35 586+75	0.3	25	.000842	4	2.7	1.44	2.83	0.8
	586+75 587+35	0.1	23	.00077	4	2.6	1.34	2.28	0.1
	587+35 596+54	0.1	9	.00036	4	2.0	0.80	2.28	0.6
	596+54 601+91	0.1	9	.00055	4	1.7	0.95	2.28	0.3
Prong No. 1	0+00 11+25	0.3	17	.0065	4	1.2	2.70	5.83	1.4
Prong No. 2	0+00 16+00	0.2	14	.0014	4	1.9	1.54	3.26	2.2

5/ Pusey Main Channel required capacity from Sta. 232+00 to 396+15 reflects a reduction of 30 cfs which will be diverted to natural channel to maintain a low flow condition in the wetland area adjacent at all time.

TABLE 3A - STRUCTURE DATA

CHANNEL

Dividing Creek Watershed, Maryland

Channel (No. or Name)	Sta. or Reach	Drainage Area		Capacity CFS	Hydraulic Gradient (Ft/Ft)	Channel Dimensions		"N" Value Aged As Built	3/ Velocities Aged As Built	Excava- tion (1000) Cu.-Yd.	Type of Improve- ment
		Sq. Mi.	Req'd			Bottom (Ft)	Depth (Ft)				
Pusey Main Prong No. 3	0+00 24+75	0.1	10	11	.001	4	1.6	.040	1.20	2.53	3.5 C E
Prong No. 4	0+00 20+40	0.1	8	10	.0005	4	1.9	.040	0.94	2.17	3.6 C E
Prong No. 5	0+00 8+80	0.2	13	13	.0012	4	1.7	.040	1.35	3.52	1.0 C E
Prong No. 6	0+00 10+80	0.5	31	32	.001	4	2.9	.040	1.62	3.03	1.5 C E
	10+80 30+90	0.4	24	24	.0009	4	2.5	.040	1.46	3.10	3.0 C E
	30+90 40+80	0.3	18	18	.0007	4	2.3	.040	1.23	2.63	1.2 C E
	40+80 50+60	0.2	14	16	.0005	4	2.4	.040	1.05	1.97	1.1 C E
S-1 of 6	0+00 7+00	0.1	10	11	.0005	4	2.0	.040	0.95	2.69	1.0 C E
	7+00 13+70	0.1	9	10	.001	4	1.5	.040	1.18	2.69	1.2 C E
	13+70 26+00	0.1	7	7	.0005	4	1.5	.040	0.83	1.68	1.8 C E
	26+00 28+35	0.1	3	3	.0005	4	1.0	.040	0.67	3.15	0.2 C E
	0+00 23+30	1.0	43	46	.0005	9	2.9	.040	1.32	2.49	4.9 C E
Prong No. 7	23+30 37+40	0.9	41	41	.0005	7	3.1	.040	1.30	2.38	2.5 C E
	37+40 45+10	0.8	39	41	.001	4	3.3	.040	1.71	3.07	1.0 C E
	45+10 68+60	0.7	30	32	.0009	4	3.0	.040	1.54	2.79	2.9 C E
	68+60 84+80	0.4	21	21	.0005	4	2.8	.040	1.12	2.34	1.9 C E
	84+80 109+95	0.1	10	10	.00075	4	1.7	.040	1.07	2.38	3.3 C E
	0+00 9+40	0.1	3	3	.0012	4	0.7	.040	0.85	3.52	1.6 C E
	9+40 17+30	0.1	2	2	.0005	4	0.8	.040	0.60	1.72	1.0 C E
	0+00 4+80	0.1	4	9	.0005	4	1.8	.040	0.90	3.52	0.6 C E
S-1 of 7	0+00 5+85	0.2	11	24	.0005	4	3.0	.040	1.15	2.52	0.7 C E
S-2 of 7	0+00 11+50	0.1	3	5	.0005	4	1.3	.040	0.77	2.83	1.4 C E
S-3 of 7	0+00 6+10	0.1	3	17	.0005	4	2.5	.040	1.05	2.17	0.6 C E
S-5 of 7	6+10 11+40	0.1	2	17	.003	4	1.5	.040	2.04	3.92	0.5 C E

TABLE 3A - STRUCTURE DATA

CHANNEL

Dividing Creek Watershed, Maryland

Channel (No. or Name)	Sta. or Reach	Drainage Area Sq. Mi.	Capacity CFS	Hydraulic Gradient (Ft/Ft)	Channel Dimensions		"N" Value Aged As Buil ^{3/}	Velocities As Buil ^{4/} Aged	Excava- tion (1000) Cu.-Yd.	Type of Improve- ment ^{2/}		
					Bottom (Ft)	Depth (Ft) Slopes						
Pusey Main												
Prong No. 8	0+00 13+50	0.1	5	13	.0005	4	2.2	.040	0.98	2.17	1.5	C E
Prong No. 9	0+00 7+70	0.1	3	4	.001	4	0.9	.040	0.90	3.52	1.0	C E
Prong No. 10	0+00 24+40	0.8	38	40	.0005	7	3.1	.040	1.28	2.07	4.7	C E
	24+40 43+20	0.7	36	37	.0005	6	3.2	.040	1.26	2.49	5.7	C E
	43+20 49+20	0.6	32	32	.0005	5	3.2	.040	1.23	2.38	1.3	C E
	49+20 64+20	0.5	29	29	.0005	4	3.3	.040	1.22	2.20	1.9	C E
	64+20 83+50	0.2	15	23	.0005	4	2.9	.040	1.15	2.22	2.3	C E
S-1 of 10	0+00 14+80	0.1	4	5	.001	4	1.0	.040	0.95	3.07	1.9	C E
S-2 of 10	0+00 11+75	0.2	11	20	.0005	4	2.7	.040	1.08	2.52	1.4	C E
Prong No. 11	0+00 19+40	0.3	18	24	.0005	4	3.0	.040	1.15	2.00	2.0	C E
	19+40 34+80	0.1	9	13	.0005	4	2.2	.040	0.98	2.17	1.6	C E
S-1 of 11	0+00 4+10	0.1	7	11	.0005	4	2.0	.040	0.94	3.26	0.4	C E
	4+10 9+00	0.1	6	11	.0005	4	2.0	.040	0.94	1.70	0.5	C E
Prong No. 12	0+00 20+10	0.5	29	29	.0005	5	3.0	.040	1.21	1.95	2.7	C E
	20+10 29+80	0.2	11	24	.0005	4	3.0	.040	1.15	1.88	0.9	C E
	29+80 33+80	0.1	5	5	.0005	4	1.3	.040	0.77	3.92	0.4	C E
S-1 of 12	0+00 4+50	0.3	18	24	.0005	4	3.0	.040	1.15	1.88	0.4	C E
	4+50 16+00	0.3	17	26	.0005	4	3.1	.040	1.18	2.03	1.2	C E
S-2 of 12	0+00 7+00	0.1	3	10	.0005	4	1.9	.040	0.93	2.83	0.6	C E
Prong No. 13	0+00 3+10	0.1	2	8	.0005	4	1.6	.040	0.85	3.92	0.4	C E
Prong No. 14	0+00 5+75	0.1	1	7	.0005	4	1.5	.040	0.83	3.07	0.6	C E
Prong No. 15	0+00 7+07	0.1	3	15	.0005	4	2.3	.040	1.02	2.17	0.9	C E
Prong No. 16	0+00 43+20	0.2	14	14	.0002	5	2.6	.040	0.72	1.15	5.8	C E

TABLE 3A - STRUCTURE DATA

CHANNEL

Dividing Creek Watershed, Maryland

Channel (No. or Name)	Sta. or Reach	Drainage Area Sq. Mi.	Capacity CFS	Hydraulic Gradient (Ft/Ft)	Channel Dimensions Bottom Depth (Ft) Slopes	"N" Value Aged As Built	Velocities 3/ Aged As Built	Excava- tion (1000) Cu.-Yd.	Type of Improvement
Lower Dividing (Worcester County)									
Prong No. 1	75+00 82+00	3.0	93	.0007	8 4.2	.040	1.82 2.44	1.1	C E
	82+00 127+00	2.8	86	.001	8 3.7	.040	2.04 3.78	8.6	C E
Prong No. 2	42+00 54+00	1.3	49	.0017	6 2.6	.040	2.17 2.60	1.4	C E
	54+00 77+00	1.1	45	.00235	4 2.8	.040	2.43 5.25	4.3	C E
Lower Dividing (Somerset County)									
Costen	35+00 39+50	1.6	75	.00345	5 3.0	.040	3.11 2.52	1.1	C E
	39+50 55+00	1.6	55	.0011	5 3.4	.040	1.92 4.58	4.8	C E
	55+00 67+00	1.4	52	.001	5 3.4	.040	1.82 3.60	3.7	C E
	67+00 89+00	1.1	45	.0008	5 3.4	.040	1.62 3.19	5.4	C E
	25+00 32+00	1.2	48	.00175	5 3.1	.040	2.30 1.98	0.5	C E
Cokesbury	32+00 33+00	1.2	47	.0005	5 3.9	.040	1.36 4.22	0.1	C E
	33+00 48+00	1.2	47	.0018	5 3.0	.040	2.25 4.72	3.2	C E
	48+00 64+00	0.8	37	.0009	5 3.0	.040	1.60 3.17	5.4	C E
	64+00 74+00	0.5	28	.0005	5 3.0	.040	1.20 2.60	3.1	C E
	74+00 90+00	0.1	9	.0005	5 1.6	.040	0.88 2.43	3.2	C E
	38+00 49+00	2.8	88	.002	8 3.4	.040	2.77 5.88	3.4	C E
Dublin	49+00 69+00	2.6	83	.0013	8 3.3	.040	2.24 4.50	9.1	C E
	69+00 85+00	2.4	75	.00125	8 3.3	.040	2.14 4.20	6.2	C E
	85+00 110+00	1.3	50	.0005	7 3.6	.040	1.40 2.74	7.8	C E
	75+00 84+00	2.1	69	.001	7 3.4	.040	1.95 3.73	1.7	C E
Tonys	84+00 117+00	2.1	68	.0012	6 3.5	.040	2.05 3.86	6.2	C E
	117+00 140+00	1.2	51	.00183	4 3.2	.040	2.28 4.56	3.1	C E

1/ All Channel Side Slopes are 1:1.

3/ As Built "N" Value .025.

2/ D B - Desilting Basin

4/ As Built Velocities are based on bank full flow or "A" drainage curve capacity, whichever is less.

C E - Channel Enlargement

August 1970

TABLE 4 - ANNUAL COST

Dividing Creek Watershed, Maryland

(Dollars)^{1/}

Evaluation Unit	Amortization of Installation Cost ^{2/}	Operation and Maintenance Cost	Total
Upper Dividing Main	16,035	4,361	20,396
Pusey Branch	15,800	4,144	19,944
Pollitts Branch	4,658	1,200	5,858
Middle Dividing Prong #3	1,915	526	2,441
Lower Worcester Prong #1	2,054	553	2,607
Prong #2	1,335	353	1,688
Lower Somerset Tony's Branch	2,568	677	3,245
Dubling Branch	3,186	905	4,091
Costen Branch	2,287	626	2,913
Cokesbury Branch	2,247	697	2,944
Project Administration	13,373		13,373
GRAND TOTAL	65,458	14,042	79,500

^{1/} Price Base: 1969^{2/} 50 Years at 5 1/8 Percent Interest.

August 1970

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Dividing Creek Watershed, Maryland

(Dollars)^{1/}

Item	<u>Estimated Average Annual Damage</u>		Damage Reduction Benefit
	Without Project	With Project	

Floodwater Crop and Pasture	93,734	14,185	79,549
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1/ Price base: Adjusted Normalized

August 1970

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Dividing Creek Watershed, Maryland

(Dollars)^{1/}

Evaluation Unit	Average Annual Benefits ^{1/}				Total	Average ^{2/} Annual Cost	Benefit Cost Ratio
	Damage Reduction	Change Land Use	Drainage	Local Secondary			
Upper Dividing	28,878	2,643	28,879	9,790	70,190	20,396	3.4:1.0
Pusey Branch	10,156	514	10,157	3,525	24,352	19,944	1.2:1.0
Pollitts Branch	4,305	386	4,305	1,465	10,461	5,858	1.8:1.0
Middle Dividing Prong #3	1,032	-	1,033	321	2,386	1,915	1.2:1.0
Lower Worcester Prong #1	11,755	881	11,756	3,949	28,341	2,607	10.9:1.0
Prong #2	5,601	-	5,601	1,395	12,597	1,688	7.5:1.0
Lower Somerset Tonys Branch	5,188	581	5,189	1,825	12,783	3,245	3.9:1.0
Dublin Branch	6,269	709	6,270	2,204	15,452	4,091	3.8:1.0
Costen Branch	3,681	430	3,682	1,301	9,094	2,913	3.1:1.0
Cokesbury Branch	2,684	323	2,685	951	6,643	2,944	2.3:1.0
Project Administration						13,373	
GRAND TOTAL	79,549	6,467	79,557	26,726	192,299	79,500	2.4:1.0

^{1/} Price Base - Adjusted Normalized.^{2/} From Table 4.

August 1970

TABLE 7 - CONSTRUCTION UNITS

Dividing Creek Watershed, Maryland

(Dollars)^{1/}

Measures in Construction Unit	Annual Benefit	Annual Cost
Upper Dividing Unit I	107,389	\$ 48,639
Lower Worcester Unit II	40,938	4,295
Lower Somerset Unit III	43,972	13,193

1/ Price Base: Adjusted Normalized

August 1970

INVESTIGATIONS AND ANALYSES

Land Treatment

The crop, pasture and forest land treatment program was developed to have essential conservation measures applied on at least 75 percent of these lands by the end of the project period. Land use and soils data were compiled to show the number of acres of each land use on well drained and poorly drained areas. The acreage of each land use with essential conservation treatment already applied was determined from Soil Conservation Service records.

The acreage to be treated during the project period is the difference between the goals of treating 75 percent of the area and the acres already treated.

Basic conservation practices were combined for the well drained and the poorly drained cropland and pasture. These measures were used as the basis to develop cost estimates for treating each acre. These costs were applied to the amount of cropland and pastureland to be treated during the project period.

The impact of the proposed drainage upon the need for increased forest fire protection has been analyzed. The average annual area burned during the past five years was 0.01 percent of the area protected compared to an allowable burn goal of 0.05 percent for the watershed. Even though the drainage will increase the forest fire hazard, maintenance roads and cleared spoil areas will provide access and firebreaks and are considered offsetting factors. Thus, present fire control facilities and programs will provide adequate protection after drainage.

The forest land treatment program was developed by the Maryland Department of Forests and Parks from field data and from soil and land use recommendations provided by the Soil Conservation Service. The program on private land includes those measures that can be reasonably installed by the landowners during the installation period. The program on Pocomoke State Forest will be part of the going land management program on State land.

Economics

The effects of the structural measures were studied in order to make estimates of annual benefits. Ten evaluation units were used. Annual benefits and annual costs were compared in order to show project feasibility. The estimated annual benefits were converted to adjusted normalized prices to determine average annual benefits for the 50-year evaluation period. The structural measures installation costs were amortized at 5 1/8 percent interest for 50 years. Annual operation and maintenance costs were added to the amortized costs to determine annual costs comparable to the annual benefits.

The land use of each field in the non-wooded areas of the watershed was marked on an aerial photo mosaic. Areas with well drained soils were outlined on the mosaic. The map was measured to determine the acreage of woodland and openland and the detailed use of the openland with well

drained soils and with poorly drained soils. The land use of the watershed is 7,169 acres of cropland, 34,436 acres of forest land and 295 acres in other uses including Pasture, idle, and homesteads. The cropland is 71 percent poorly drained and the forest land 93 percent poorly drained. The cropland use is 45 percent corn, 42 percent soybeans, 9 percent truck crops, and 4 percent in hay and small grain.

Landowners and operators were interviewed to obtain basic data regarding watershed problems, crop yields, production practices, needs and future land use intentions. It was found that sufficient lime and fertilizer along with quality management are being used to produce desirable yields. These yields are achieved except when damage producing floods and high water tables are experienced. Entire crop losses are experienced in parts of fields about one year in five.

In some cases, these losses are more frequent. Improved group channels which will provide outlets for on-farm drainage systems are needed. The farmers expressed a desire to shift more acreage to truck crop production and will do so with the reduction of floodwater and drainage problems.

The economic evaluation of the stream channel improvements is based on increased net farm income expected in the problem area. For evaluation purposes, the land in the feed grain and soil bank programs was considered as corn land for the without project conditions. Estimates of gross farm income from crop and pasture production were made for without project, with project only, flood free and with project after changed land use. Associated costs, including increased variable or cash production costs and land treatment costs, were estimated for the latter three conditions.

The difference between the gross income with the project and without the project, less associated costs and adjusted for accrual lag, is the benefit from the reduction of floodwater damages and relief of drainage problems. The adjusted difference between the flood free condition and with project condition, less associated costs, is the remaining floodwater damages with the project. The difference in gross income between the with project after land use changes condition and with project condition, less associated costs and adjusted for lag in accrual, is the changed land use benefit from flood prevention and improved drainage.

The primary benefits are the result of the joint flood prevention and agricultural water management purposes of the project. These purposes will bring about more stable crop production and make it feasible to make land use adjustments. The agricultural water management drainage problem will be solved with this project. The floodwater damages will be reduced with the project. The relationship of the four conditions described above show the extent of damage reduction.

Local secondary benefits stemming from the project and induced by the project were estimated to be ten percent of the increased returns and ten percent of the increased production costs, incurred by the primary producers, with the project installed.

The structural measures costs are based on current prices. The costs of stream channel improvements were allocated to flood prevention and agricultural water management. All of the costs are joint costs; therefore, 50 percent was allocated to flood prevention and 50 percent to agricultural water management. Public Law 566 funds will bear 100 percent of the construction cost allocated to flood prevention, 50 percent of the cost allocated to drainage, and 100 percent of the engineering services. Other funds will bear 50 percent of the construction cost allocated to drainage, 100 percent of the land rights costs and 100 percent of the administration of contracts costs. Other project administration costs will be borne by Public Law 566 funds.

The Watershed Protection Handbook and the Economics Guide were used as technical guides. Publications by the University of Maryland were used as technical references. The 1964 Census of Agriculture was used as a general reference.

Fish and Wildlife Investigations

Biologists from the Soil Conservation Service, the Maryland Fish and Wildlife Administration, the Maryland Department of Natural Resources and the Bureau of Sport Fisheries, U. S. Fish and Wildlife Service have studied and prepared Biological Reports concerning the environmental impact of the proposed works of improvements. Their recommendations have been considered and agreement has been reached with the Sponsors, the Maryland Department of Natural Resources and the Soil Conservation Service on satisfactory measures to preserve the environmental ecology of the area as much as practical. These measures are described in detail in "Works of Improvement to the Installed" and "Effects of Works of Improvement".

ENGINEERING (MULTIPLE-PURPOSE CHANNELS)

Engineering

Surveys for multiple-purpose channels consisted of a third order vertical control net. Horizontal control was established by open traverse surveys and the use of semi-controlled mosaics. Channel and valley cross-sections, spot elevations at field controls, and watershed perimeters were taken at the required intensity.

Property lines and ditch locations were plotted on the semi-controlled mosaic. Final alignment was established in the main channels and main tributaries. Minor tributaries and ditches are in the general location of the final alignment. Any final alignment established during the operation phase will in no way affect the criteria of benefiting two or more beneficiaries.

Water surface profiles were analyzed by computer, starting at the Pocomoke River and through the main channel to establish the construction starting point. Hydraulic gradients were set by profiles and control elevations. The design discharges were determined following the Northeast Humid Area Chart and the 20-40 rule from the National Engineering

Handbook, Section 16. The "C" curve for good agricultural drainage was used in computing these discharges.

Pipes, culverts, and channels were designed using Manning's Formula. Channel "n" Values varied from .035 to .040 depending upon the hydraulic radius. During final design, channel grades and velocities will be checked for compliance with current standards.

Excavation quantities were computed assuming full excavation of the section. Clearing and disposal quantities were computed from scaled distances on the mosaic. Woodland clearing widths were estimated on minimum requirements for spoil placement and machinery utilization. Cropland clearing widths were measured in the field. Spoil spreading and shaping were computed for cropland and woodland reaches. The spoil disposal will be done in accordance with SCS specifications.

Recent observations and study indicate that channels built under conditions of topography, soils and hydraulic dimensions similar to these function without significant degradation of the channel bed. Aggradation of channel bottoms from the deposition of sediment and vegetative material has historically depleted channel cross-sections and created maintenance problems. The planned stabilization and erosion control measures along with a proper maintenance program will minimize in bank deposition and insure proper channel functioning during the project life.

The designed water surface varies from over bank flow in swamped areas to from 6 inches to one foot below ground surface in agricultural land. On Pusey Branch the channel improvements will be located on the west side of the flood plain to preserve as much of the wooded wet land as feasible. This diversion will start at the head of the wet lands and will extend downstream approximately 3 miles. A control structure, including a creosoted wood weir and a battery of 4 - 18" bituminous corrugated pipes, will provide for the March 10 day low flow (30 cfs) to pass continuously through the natural stream channel. A continuous levee constructed on the wet land side of the new channel will preserve the wet land condition of the remaining flood plain. At the lower end of the diversion a second control structure will be installed which will be about 200' upstream of old Furnace Road Bridge. This structure composed of a head wall and battery of 4 - 24" corrugated pipes will control raveling in the natural channel by dispersing the low flows into the new channel bottom, which is two feet lower than the natural channel. Flows exceeding approximately 30 cfs will use the new channel up to its design capacity. Extreme flows will use both channels and the flood plain. Approximately 750 feet below Furnace Road, the channel will end in a desilting basin designed to trap sediment and debris. On Main Dividing Creek there has been some discussion on a proposal for the future development of two privately owned and sponsored lakes. The main outlet channel has been designed in such a way that it will operate satisfactorily with or without the proposed impoundments. If the impoundments are not installed, a settling basin will be installed at the lower end of the channel. On Pollitts Branch and other major tributaries, the channel impoundments will be constructed at the edge of wooded wet lands wherever feasible to preserve this valuable resource.

Seeding will be provided in approximately 8 foot wide strips on each side along the channels in cropland areas and all of the cleared woodland will be seeded. Also, seeding along the channel slopes is planned immediately after the ditch is dug. A minimum of 81 pipes are included to provide accessibility for channel maintenance after construction is completed. Additional pipes will be provided as needed in the cropland area for erosion control and side drainage.

Unit costs were determined from recent contracts on similar projects in the area.

Geologic Investigation

The geologic investigation was conducted by hand auger borings at scattered locations along proposed channel routes in the watershed area. Following is a generalized description of site conditions and foundation soils encountered in this investigation.

Dividing Creek Main and Pollitts Branch have the following soils: Organic topsoil to 0.5 foot, 1 to 2 feet of SM silty sand which is fine and contains 15 to 20 percent silt fines which is underlain by clean SP fine sand with less than 10 percent silt fines. The water table averages 2 feet below ground surface.

Pusey Branch soils are quite different from those encountered on Dividing Creek and Pollitts Branch from Station 205+99 to Station 372+07 (3.1 miles) on Pusey Branch. Swampy conditions in the flood plain were encountered during the investigation. Beneath the surface water is an average thickness of 1 foot of OL; soft, organic clay silt containing some plant fragments underlain by 1.5 to 2.0 feet of moderately cohesive SM silty fine sand with 25 to 40 percent clayey silt fines. Below 3 feet in depth the silt content decreases rapidly until a fairly clean SM or SP is encountered at 4 or 6 feet in depth.

Above station 372+07 on Pusey Branch, swampy conditions no longer prevail, primarily due to drainage operations conducted some time in the past. The soils encountered consist of 0.5 feet of topsoil underlain by 1.5 feet of SM silty fine sand with 25 to 35 percent organic clay-silt fines and is overall loose to medium dense. This is underlain by moderately to strongly cohesive soils varying from CLs thru high clayey silt content SMs. Occasionally, SPs are encountered at depths below ground level.

In general, the results of this investigation indicate that there will be approximately 2.5 miles of channel work which will be constructed in swampy terrain involving special construction techniques in order to move machinery along the channel excavation.

The soils along Dividing Creek Main and Pollitts Branch are made up of fine sands without binding materials such as clays or plastic silts and

are subject to bank sloughing when freshly excavated. Design and construction techniques have considered the limitations of these soils and rapid vegetation of disturbed areas plus desilting basins will be incorporated in the plan. A stability analysis was made to conform with SCS requirements.

The foundation soils of Pusey Branch are much less restrictive as regards channel bank stability as there are 3 to 6 feet of relatively cohesive soils reducing erosion potential. However, provisions for rapid vegetation of disturbed areas and desilting basins along the channel route will be incorporated in the plan.



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PROJECT MAP

DIVIDING CREEK WATERSHED

SOMERSET, WICOMICO, AND WORCESTER COUNTIES

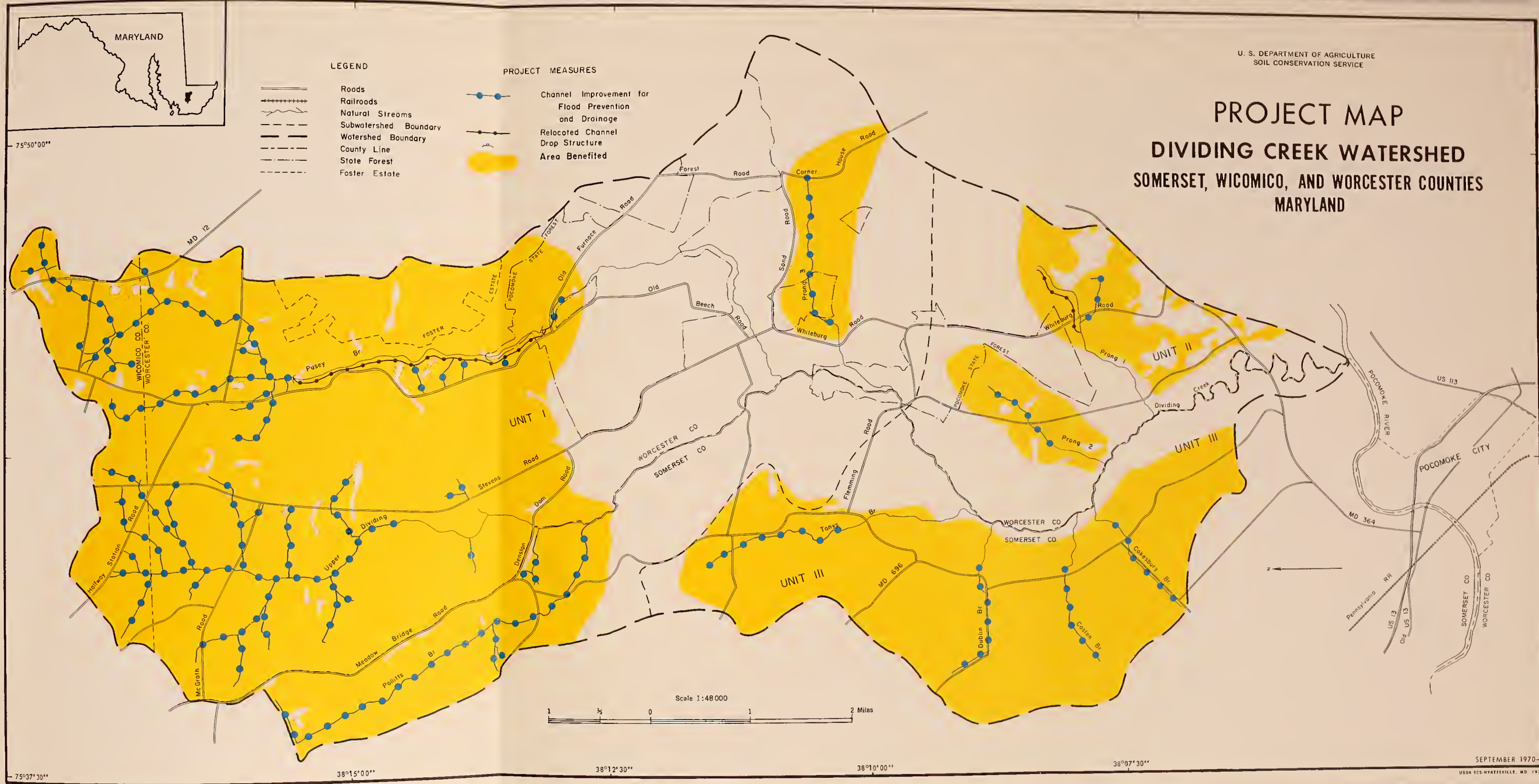
MARYLAND

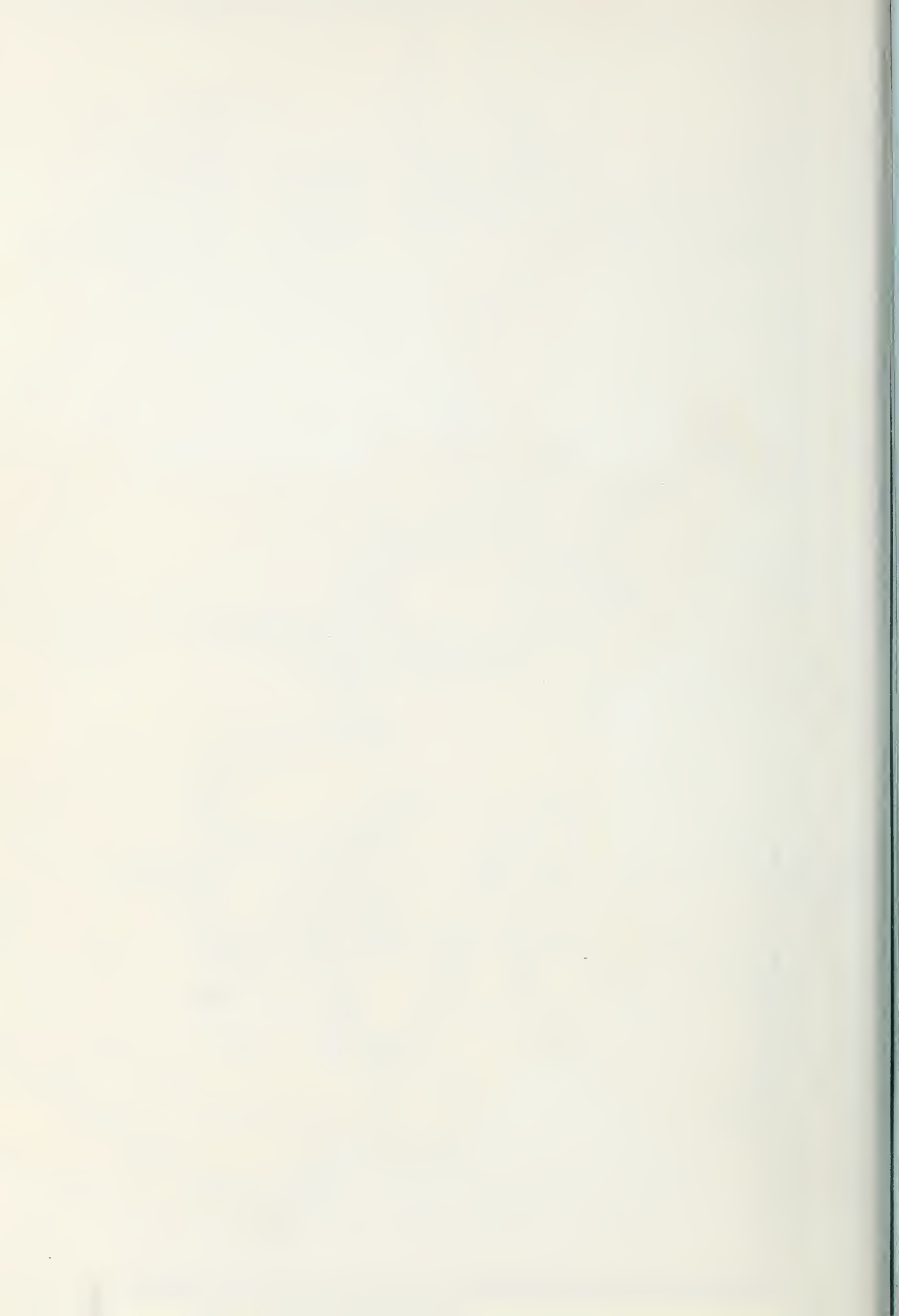
LEGEND

- Roads
- Railroads
- Natural Streams
- Subwatershed Boundary
- Watershed Boundary
- County Line
- State Forest
- Foster Estate

PROJECT MEASURES

- Channel Improvement for Flood Prevention and Drainage
- Relocated Channel Drop Structure
- Area Benefited









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